UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
BIN C15700
Seattle, WA 98115-0070

Refer to:
2002/00598

August 30, 2002

Mr. Bob Graham
Natural Resources Conservation Service
101 SW Main Street, Suite 1300
Portland, Oregon 97204-3221

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Act Essential Fish Habitat Consultation for the Drift Creek Pasture Renovation Project, Siletz River Basin Lincoln, County, Oregon.

Dear Mr. Graham:

Enclosed is a biological opinion (Opinion) prepared by the National Marine Fisheries Service (NOAA Fisheries) pursuant to section 7 of the Endangered Species Act (ESA) for the Drift Creek Pasture Renovation Project, Lincoln County, Oregon. NOAA Fisheries concludes in this Opinion that the proposed action is not likely to jeopardize Oregon Coast (OC) coho salmon (*Oncorhynchus kisutch*). Pursuant to section 7 of the ESA, NOAA Fisheries has included reasonable and prudent measures with non-discretionary terms and conditions that are necessary and appropriate to minimize the potential for incidental take associated with this project. This Opinion also serves as consultation on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act and its implementing regulations (50 CFR 600).

Please direct any questions regarding this letter to Robert Anderson of my staff in the Oregon Habitat Branch at 503.231.2226.

Sincerely,

Russell M Strach for

D. Robert Lohn
Regional Administrator

Endangered Species Act - Section 7 Consultation
and
Magnuson-Stevens Act Essential Fish Habitat Consultation

Biological Opinion

Drift Creek Pasture Renovation Project,
Siletz River Basin,
Lincoln County, Oregon

Agency:	Natural Resources Conservation Service
Consultation Conducted by:	NOAA Fisheries, Northwest Region
Date Issued:	August 30, 2002
Issued by:	Russell M Strach for D. Robert Lohn Regional Administrator
Refer to:	**2002/00598**

TABLE OF CONTENTS

1. ENDANGERED SPECIES ACT 1
   - 1.1 Background 1
   - 1.2 Proposed Action 1
   - 1.3 Biological Information 2
   - 1.4 Evaluating Proposed Actions 3
     - 1.4.1 Biological Requirements 4
     - 1.4.2 Environmental Baseline 4
   - 1.5 Analysis of Effects 5
     - 1.5.1 Effects of Proposed Action 5
       - 1.5.1.1 Habitat Access 5
       - 1.5.1.2 Fish Harassment 6
       - 1.5.1.3 Total Suspended Solids 6
       - 1.5.1.4 Riparian Enhancement 7
       - 1.5.1.5 Petrochemicals 8
     - 1.5.2 Cumulative Effects 8
   - 1.6 Conclusion 8
   - 1.7 Reinitiation of Consultation 8

2. INCIDENTAL TAKE STATEMENT 9
   - 2.1 Amount or Extent of Take 9
   - 2.2 Reasonable and Prudent Measures 10
   - 2.3 Terms and Conditions 10

3. MAGNUSON-STEVENS ACT 14
   - 3.1 Background 14
   - 3.2 Magnuson-Stevens Fishery Conservation and Management Act 15
   - 3.3 Identification of EFH 16
   - 3.4 Proposed Action 16
   - 3.5 Effects of Proposed Action 18
   - 3.6 Conclusion 18
   - 3.7 EFH Conservation Recommendations 18
   - 3.8 Statutory Response Requirement 18
   - 3.9 Supplemental Consultation 18

4. LITERATURE CITED 19

1. ENDANGERED SPECIES ACT

1.1 Background

On June 10, 2002, the National Marine Fisheries Service (NOAA Fisheries) received a letter from the Natural Resources Conservation Service (NRCS) requesting formal consultation pursuant to the Endangered Species Act (ESA) for funding of the Drift Creek Pasture Renovation Project, Siletz River basin, Lincoln County, Oregon. Enclosed with the letter was a biological assessment (BA) describing the proposed action and potential effects that may result from project implementation. In the project proposal, the NRCS determined that the proposed action was likely to adversely affect Oregon Coast (OC) coho salmon (*Oncorhynchus kisutch)*, an ESA-listed species.

This biological opinion (Opinion) considers the potential effects of the proposed action on OC coho salmon, which occur in the proposed action area. OC coho salmon were listed as threatened under the ESA on August 10, 1998 (63 FR 42587) and protective regulations were issued on July 10, 2000 (65 FR 42422). The objective of this Opinion is to determine whether the proposed action is likely to jeopardize the continued existence of OC coho salmon. This consultation is conducted pursuant to section 7(a)(2) of the ESA and its implementing regulations, 50 CFR 402.

1.2 Proposed Action

The NRCS proposes to fund a pasture renovation project located at the confluence of Drift and Anderson Creeks in Lincoln County, Oregon. The project covers a 30-acre area and includes the following features: (1) Pasture renovation and management (cultivation, planting, and a grazing management plan); (2) culvert removal and bridge construction; (3) riparian enhancement; (4) nutrient management; (5) fencing; and (6) out-building construction. The purpose of the proposed action is to improve primary agricultural production and minimize riparian and in-stream habitat degradation from grazing and nutrient runoff.

An existing culvert will be removed and replaced with a single-span bridge spanning the 100-year flood elevation to re-establish stream functions. All machinery for culvert removal and bridge construction will be operated from top-of-bank. No treated wood is proposed or authorized. Bridge abutments will be constructed above the active floodplain (100-year flood elevation). Riparian enhancement includes plantings intended to establish a 50-foot stream buffer along 1600 feet of streambank to improve riparian functions. The riparian buffer will be fenced to exclude grazing livestock. The out-buildings will be constructed outside of the active floodplain and at least 300 feet from the ordinary high water line.

All in-water work (culvert removal and site remediation) is proposed to occur during the Oregon Department of Fish and Wildlife (ODFW)-recommended in-water work window, July 1 to September 15 (ODFW 2000).

1.3 Biological Information

OC coho salmon use the action area for rearing and migration. The timing of life history events of OC coho salmon in the Drift Creek watershed is summarized in Table 1.

Table 1. OC coho salmon life history events (Weitkamp 1995).

	J	F	M	A	M	J	J	A	S	O	N	D
River Entry	■									■	■	■
Spawning	■	■									■	■
Intragravel Development	■	■	■	■	■						■	■
Juvenile Rearing	■	■	■	■	■	■	■	■	■	■	■	■
Juvenile Out-migration			■	■	■	■						

Estimated escapement of coho salmon in Coastal Oregon was about 1.4 million fish in the early 1900s, with harvest of nearly 400,000 fish (Weitkamp *et al.* 1995). Abundance of wild OC coho salmon declined during the period from about 1965 to 1975 and has fluctuated at a low level since that time (Nickelson *et al.* 1992). Lichatowich (1989) concluded that production potential (based on stock recruit models) for OC coho salmon in coastal Oregon rivers was only about 800,000 fish, and he associated this decline with a reduction of nearly 50% in habitat capacity. Current abundance of coho on the Oregon coast may be less that 5% of that in the early part of the 1900s. Recent spawner abundance in this evolutionarily significant unit (ESU) has ranged from about 20,000 adults in 1990 to near 80,000 adults in 1996, and an estimated 47,400 adult coho in 1999 (Jacobs *et al.* 2001).

The OC coho salmon ESU is disproportionately distributed throughout its range. OC coho salmon escapements within the northern (including the Drift and Anderson Creeks) and mid-coast basins have averaged 39.8% of total escapement over the 1990-1999 period of record. While OC coho salmon escapements within the southern basins have averaged 60.2% of total escapement over the 1990-1999 period of record (Jacobs *et al.* 2001). Reasons for this high productivity are probably related to additional rearing opportunities associated with the lakes in the southern basins, and the relative sizes of the watersheds within these respective basins (Jacobs *et al.* 2001).

Estimated spawning populations for naturally produced coho in Drift Creek averaged 2730 adults from 1923 to 1940. Population estimates during this period were estimated using the proportion of suitable habitat in respective subbasins to develop proportional populations relative to the Siletz Basin as a whole (USFS 1996). Population estimates for the period 1990 through 1995 use miles of suitable habitat per subbasin (Drift Creek) to develop estimates. These results are summarized in Table 2.

Table 2. Estimated spawning populations for naturally produced coho in the Siletz Basin and Drift Creek (USFS 1996).

Year	Miles Surveyed	Fish mile^{-2}	Estimated Siletz Basin Population	Estimated Drift Creek Population	Relative Abundance Drift Creek
1923 -1940	----------	~230	~33000	2730	8.3%
1990	9.32	3.5	441	41	9.3%
1991	8.52	7.9	984	93	9.5%
1992	10.55	19.6	2447	231	9.4%
1993	12.57	3.2	400	38	9.5%
1994	7.78	7.7	967	91	9.4%
1995	8.33	3.34	417	39	9.4%

Survey data collected by ODFW in the Drift Creek watershed (2000) estimated juvenile densities ranging from 0.9 to of 1.1 fish m^{-2} (Rodgers 2000). Survey data exclusive to Drift Creek produced a juvenile density of 0.00 fish m^{-2} (Rodgers 2000).

1.4 Evaluating Proposed Actions

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA (50 CFR 402). NOAA Fisheries must determine whether the action is likely to jeopardize the listed species. This analysis involves the initial steps of defining the biological requirements and current status of the listed species, and evaluating the relevance of the environmental baseline to the species' current status.

Subsequently, NOAA Fisheries evaluates whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NOAA Fisheries must consider the estimated level of mortality attributable to: (1) Collective effects of the proposed or continuing action; (2) the environmental baseline; and (3) any cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed salmonid's life stages that occur beyond the action area. If NOAA Fisheries finds that the action is likely to jeopardize the listed species, NOAA Fisheries must identify reasonable and prudent alternatives for the action.

For the proposed action, NOAA Fisheries' jeopardy analysis considers direct or indirect mortality of fish attributable to the action. NOAA Fisheries considers the extent to which the proposed action impairs the function of essential elements necessary for juvenile and adult migration, spawning, and rearing of OC coho salmon under the existing environmental baseline. NOAA Fisheries' essential fish habitat (EFH) analysis considers the effects of proposed actions

on EFH and associated species and their life history stages, including cumulative effects and the magnitude of such effects.

1.4.1 Biological Requirements

The first step in the methods NOAA Fisheries uses for applying the ESA to listed salmon is to define the biological requirements of the species most relevant to each consultation. NOAA Fisheries also considers the current status of the listed species taking into account population size, trends, distribution and genetic diversity. To assess the current status of the listed species, NOAA Fisheries starts with the determinations made in its decision to list OC coho salmon for ESA protection and also considers new data available that are relevant to the determination.

The relevant biological requirements are those necessary for OC coho salmon to survive and recover to naturally-reproducing population levels at which protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stock, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment.

For this consultation, the biological requirements are improved habitat characteristics that function to support successful rearing and migration. The current status of OC coho salmon, based upon their risk of extinction, has not significantly improved since the species was listed and, in some cases, their status may have worsened.

1.4.2 Environmental Baseline

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area (project area) involved in the proposed action (50 CFR 402.02). The direct effects occur at the project site and may extend throughout the watershed based on the potential for displacement of rearing coho salmon, injury to or killing of coho salmon, elevated levels of total suspended solids (concentration and duration), and pollutant discharge into Drift Creek, Anderson Creek, and Siletz Bay. Indirect effects may occur beyond the project site where actions described in this Opinion lead to additional activities or affect ecological functions contributing to aquatic habitat degradation. For this consultation, the action area includes all stream reaches accessible to OC coho salmon from river mile 1.75 (approximate) of Drift Creek to the confluence with Siletz Bay, and includes the channel migration zone (CMZ).

Regulations implementing section 7 of the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, state, or private actions and other human activities in the action area. The environmental baseline also includes the anticipated effects of all proposed Federal projects in the action area that have undergone section 7 consultation, and the impacts of state and private actions that are contemporaneous with the consultation in progress.

Land uses in the action area include urban, residential, agricultural, forestry, and recreation. Riparian areas and stream channels in coastal watersheds have been damaged by development activities related to these land uses as well as by the use of splash dams, stream cleaning, and gravel mining (FEMAT 1993, Botkin *et al.* 1995, OCSRI 1997). Habitat changes that have contributed to the decline of OC coho in the action area include: (1) Reduced biological, chemical, and physical connectivity between streams, riparian areas, flood plains, and uplands; (2) elevated fine sediment loads; (3) reduced instream and riparian large woody debris, which traps sediments, stabilizes streambeds and streambanks, and forms complex instream structure; (4) reduced vegetative canopy; (5) changed stream channel morphology (*e.g.*, increased width-to-depth ratios and entrenchment); (6) degraded water quality; (7) altered base and peak stream flows; and (8) fish passage impediments (USFS 1996, OCSRI 1997).

Using procedures in NMFS (1996), the BA identified the following environmental baseline indicators as at risk or not properly functioning in the action area: Temperature, turbidity, chemical contamination/nutrients, substrate, large woody debris, pool frequency, pool quality, off-channel habitat, refugia, width-to-depth ratio, floodplain connectivity, peak/base flows, drainage network, road density, and riparian reserves. Drift Creek is on the Oregon Department of Environmental Quality (ODEQ) 303(d) List of Water Quality Limited Water Bodies for temperature.

NOAA Fisheries concludes that not all of the biological requirements of the subject species within the action area are being met under current conditions. Based on the best available information on the status of the affected species, population status, trends, and genetics, and the environmental baseline conditions within the action area, significant improvement in habitat conditions over those currently available under the environmental baseline is needed to meet the biological requirements for survival and recovery of this species.

1.5 Analysis of Effects

1.5.1 Effects of Proposed Action

The proposed action will temporarily impair juvenile OC coho salmon passage to upstream and downstream habitats, will temporarily displace rearing juvenile OC coho salmon, and may injure or kill (or more likely temporarily displace) juvenile OC coho salmon during installation and removal of in-water isolation structures. De-watering, fish removal, and fish handling, a temporary increase in total suspended solids, enhancement of riparian habitat and functions, and the possible introduction of petrochemicals into the stream are also possible outcomes of the proposed action.

1.5.1.1 Habitat Access

Isolation of the stream to remove the culvert and minimize adverse effects to OC coho salmon will prevent upstream and downstream passage for OC coho salmon for a period of less than 24 hours. Displacement of OC coho salmon from upstream and downstream rearing habitats may

cause short-term increases in expenditure of energy, physiological stress, and/or reduction in feeding rates. NOAA Fisheries expects that these short-term effects (less than 24 hours) will not significantly affect OC coho salmon behavior, development, or survival.

1.5.1.2 Fish Harassment

Fish may be killed, or more likely temporarily displaced, by in-water work activities. The most lethal biological effects of the proposed action on OC coho salmon will likely be caused by the isolation of in-water work areas and fish removal and handling. Although in-water work area isolation is itself a conservation measure intended to minimize adverse effects from instream construction activities to fish present in the work isolation area, some fish mayl be captured, handled, and released. Capturing and handling fish causes physiological stress, though overall effects of the procedure are generally short-lived if appropriate precautions are exercised. The primary factors controlling the likelihood of stress and death from handling are differences in water temperatures (between the stream and transfer containers), dissolved oxygen concentrations, the amount of time that fish are held out of the water, and the degree of physical trauma. Stress on salmonids increases rapidly from handling if the water temperature exceeds 18°C or dissolved oxygen concentration is below saturation.

The proposed in-water work timing (July 1 to September 15), the short period of in-water work (4 to 5 days), and the proposed fish removal methods that require supervision by a fishery biologist experienced with work area isolation, are likely to minimize the adverse effects described above.

1.5.1.3 Total Suspended Solids

The proposed action is likely to result in temporary increases in elevated concentrations of total suspended solids from in-water work activities (*e.g.*, culvert removal). The potential effects of exposure to elevated concentrations in total suspended solids on OC coho salmon include, but are not limited to: Reduction in feeding rates, mortality, physiological stress, changes in behavior, reduction in macroinvertebrate population size, and temporary beneficial effects. Influences of total suspended solids and turbidity, defined as a measurement of relative clarity due to an increase in undissolved particles (suspended solids), on fish reported in the literature range from beneficial to detrimental. Potential beneficial effects associated with temporary increases in total suspended solids include a reduction in piscivorous fish/bird predation rates, enhanced cover conditions, and improved survival conditions. Increases in total suspended solids have also been reported to cause physiological stress, reduce growth, and reduce survival.

Salmonids have been observed to move laterally and downstream to avoid turbid plumes (Sigler *et al.* 1984, Lloyd 1987, Servizi and Martens 1991). Juvenile salmonids tend to avoid streams that are chronically turbid, such as glacial streams or those disturbed by human activities, except when the fish must traverse these streams along migration routes (Lloyd *et al.* 1987). In addition, a potential positive effect is providing refuge and cover from predation; fish that remain in turbid waters experience a reduction in predation from piscivorous fish and birds

(Gregory and Levings 1998). In habitats with intense predation pressure, this provides a beneficial trade-off (*e.g.*, enhanced survival) to the cost of potential physical effects (*e.g.*, reduced growth).

Exposure duration is a critical determinant of the occurrence and magnitude of physical or behavioral effects (Newcombe and MacDonald 1991). Salmonids have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with floods, and are adapted to such high pulse exposures. Adult and larger juvenile salmonids appear to be little affected by the high concentrations of suspended sediments that occur during storm and snowmelt runoff episodes (Bjornn and Reiser 1991). However, chronic exposure can cause physiological stress that can increase maintenance energy and reduce feeding and growth (Redding *et al.* 1987, Lloyd 1987, Servizi and Martens 1991).

Turbidity, at moderate levels, has the potential to reduce primary and secondary productivity, and at high levels, has the potential to interfere with feeding and to injure and kill adult and juvenile fish (Spence *et al.* 1996, Bjornn and Reiser 1991). Other behavioral effects on fish, such as gill flaring and feeding changes, have been observed in response to pulses of suspended sediment (Berg and Northcote 1985). Fine redeposited sediments also have the potential to reduce primary and secondary productivity (Spence *et al.* 1996), and to reduce incubation success and interstitial rearing space for juvenile salmonids (Bjornn and Reiser 1991).

Increases in total suspended solids can adversely affect filter-feeding macroinvertebrates and fish. At concentrations of 53 to 92 ppm (24 hours) Gammon (1970) reported reductions in macroinvertebrate population sizes. At concentrations of 250 ppm (1 hour) Noggle (1978) reported a 95% reduction in feeding rates in juvenile coho salmon. At concentrations of 1200 ppm (96 hours) mortality to juvenile coho salmon were reported (Noggle 1978). Concentrations of 53.5 ppm (12 hours) caused physiological stress and changes in behavior in coho salmon (Berg 1983). Concentrations and exposure times from in-water work activities that meet or exceed these effect levels are reasonably certain to harm OC coho salmon present in the action area. Effects to juvenile OC coho salmon from turbid waters is likely to occur during initial pulses of suspended solids associated with the start of in-water work activities. OC coho salmon are likely to avoid waters that are chronically turbid, and therefore adverse effects are less likely after initial exposure.

The relative low abundance of juvenile OC coho salmon in the action area during the in-water work period, the short period of in-water work (less than 24 hours), and in-water work isolation measures are likely to minimize the adverse effects described above to juvenile salmonids.

1.5.1.4 Riparian Enhancement

A 1.84-acre area (measuring 50 feet in width by 1600 feet in length) of native riparian tree and shrub plantings will be planted along the streambanks to reestablish a riparian buffer and promote riparian functions. The riparian buffer will be fenced to exclude livestock grazing. The proposed riparian enhancement plan will enhance streambank stability, provide nutrient influx,

provide cover, shade the streams from solar radiation, and provide a potential recruitment source of large woody debris in the long term (greater than 10 years). Limited functions will be provided until the plantings are fully established. Overall, the proposed riparian enhancement activities would improve riparian habitat structure and associated functions.

1.5.1.5 Petrochemicals

As with all construction activities, accidental release of petrochemicals and toxic substances into the physical environment may occur. Petroleum-based contaminants (such as fuel, oil, and some hydraulic fluids) contain polycyclic aromatic hydrocarbons (PAHs) which can cause sublethal (such as immune dysfunction), as well as lethal effects, to salmonids and other aquatic organisms, depending upon concentration, duration, lifestage, and organism (Neff 1985).

1.5.2 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." Other activities within the watershed have the potential to impact fish and habitat within the action area. Future Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities are being (or have been) reviewed through separate section 7 consultation processes.

Non-Federal activities within the action area are expected to increase due to a projected 34% increase in human population over the next 25 years in Oregon (ODAS 1999). Thus, NOAA Fisheries assumes that future private and state actions will continue within the action area, increasing as population density rises.

1.6 Conclusion

NOAA Fisheries has determined that, based on the available information, the Drift Creek Pasture Renovation Project is not likely to jeopardize the continued existence of OC coho salmon. NOAA Fisheries used the best available scientific and commercial data to apply its jeopardy analysis, and analyzed the effects of the proposed action on the biological requirements of the species relative to the environmental baseline, together with cumulative effects. The proposed action is reasonably certain to cause short-term degradation of anadromous salmonid habitat due to in-stream construction activities (culvert removal) and short-term elevated concentrations in total suspended solids. Fish may be killed, or more likely temporarily displaced, by in-water work activities. This take will be minimized due to the low abundance of OC coho salmon in the action area during the recommended in-water work window (July 1 to September 15), the short period of in-water work (less than 24 hours), and supervision of fish removal and handling by a qualified fisheries biologist. Overall, NOAA Fisheries expects that the project will maintain needed habitat elements over the long term.

1.7 Reinitiation of Consultation

This concludes formal consultation on these actions in accordance with 50 CFR 402.14(b)(1). The NRCS must reinitiate consultation if: (1) The amount or extent of incidental take is exceeded; (2) the action is modified in a way that causes an effect on the listed species that was not previously considered in the biological assessment and this Opinion; (3) new information or project monitoring reveals effects of the action that may affect the listed species in a way not previously considered; or (4) a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16). In instances where the amount or extent of authorized incidental take is exceeded, any operations causing such take must cease pending conclusion of the reinitiated consultation.

2. INCIDENTAL TAKE STATEMENT

Section 9 and rules promulgated under section 4(d) of the ESA prohibit any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of listed species without a specific permit or exemption. "Harm" is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, and sheltering. "Harass" is defined as actions that create the likelihood of injuring listed species by annoying it to such an extent as to significantly alter normal behavior patterns which include, but are not limited to, breeding, feeding, and sheltering. "Incidental take" is take of listed animal species that results from, but is not the purpose of, the Federal agency or the applicant carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

2.1 Amount or Extent of Take

NOAA Fisheries anticipates that the proposed action covered by this Opinion is reasonably certain to result in incidental take (lethal and non-lethal) of juvenile OC coho as a result of: (1) In-water work activities, culvert removal and fish removal and handling; (2) increases in total suspended solids; and (3) temporary limits on habitat access for juvenile OC coho salmon in the action area. Take in association with water quality changes is largely unquantifiable, although reasonably certain based on the analysis in section 1.5. Take from work area isolation and fish removal and handling may be either lethal or non-lethal. The extent of non-lethal take for this opinion is limited to take resulting from activities undertaken as described in this Opinion that occurs in the action area [all stream reaches accessible to OC coho salmon from river mile 1.75 (approximate) on Drift Creek to the confluence with Siletz Bay, and includes the CMZ]. Non-lethal take from fish removal and handling shall not exceed 10 juvenile OC coho salmon.

Lethal take resulting from the capture or killing of listed salmonids is limited to activities described in this Opinion that occur in the isolated, in-water work area during the in-water work period. Lethal take shall not exceed five juvenile OC coho salmon.

2.2 Reasonable and Prudent Measures

NOAA Fisheries believes the following reasonable and prudent measures are necessary and appropriate to minimize take of the above species. Minimizing the amount and extent of take is essential to avoid jeopardy to the listed species.

The NRCS shall:

1. Minimize the amount and extent of incidental take from construction activities within the proposed action area by ensuring that effective measures are developed, implemented, and maintained to limit the duration and extent of in-water work, and to time such work when effects to OC coho salmon are minimized.

2. Minimize the amount and extent of incidental take from construction activities in or near watercourses by ensuring that effective erosion and sedimentation control measures are developed, implemented, and maintained to avoid or minimize the movement of soils and sediment both into and within watercourses and to stabilize bare soil over the short and long term.

3. Minimize the amount and extent of incidental take from construction activities in or near watercourses by ensuring that an effective spill prevention, containment, and control plan is developed, implemented, and maintained to avoid or minimize point-source pollution both into and within watercourses over the short and long term.

4. Minimize the extent of effects to riparian habitat features, or where effects are unavoidable, replace or restore lost riparian habitat features.

5. To ensure effectiveness of implementation of the reasonable and prudent measures, all fish removal and handling, erosion control plans, pollution and hazardous materials containment, prevention and control plans, and riparian planting efforts, shall be monitored and evaluated both during and following construction.

2.3 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the NRCS must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions should be incorporated into construction contracts and subcontracts to ensure that the work is carried out in the manner prescribed. Implementation of the terms and conditions within this Opinion will further reduce the risk of adverse affects to fish. These terms and conditions are non-discretionary.

1. To implement reasonable and prudent measure #1 (in-water work), above, the NRCS shall ensure that:

a. Displacement from and access to upstream and downstream habitats for juvenile OC coho does not exceed 48 hours.
b. All work within the active channel of Drift Creek and Anderson Creek is completed within the established in-water work period, July 1 to September 15. Any adjustments to the in-water work period must be approved by NOAA Fisheries.
c. Instream substrates removed in association with culvert extraction are replaced with clean spawning gravels.
d. All water intakes used for the project must have a fish screen installed, operated, and maintained according to NOAA Fisheries' fish passage standards (available at http//:www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm).
e. Capture and release. Before and intermittently during pumping to isolate an in-water work area, an attempt must be made to capture and release fish from the isolated area using trapping, seining, electrofishing, or other methods as are prudent to minimize risk of injury.
    i. A fishery biologist experienced with work area isolation and competent to ensure the safe handling of all ESA-listed fish must conduct or supervise the entire capture and release operation.
    ii. If electrofishing equipment is used to capture fish, the capture team must comply with NOAA Fisheries' electrofishing guidelines (available at http//www:ner.noaa.gov/1salmon/salaesa/pubs/electrog.pdf).
    iii. The capture team must handle ESA-listed fish with extreme care, keeping fish in water to the maximum extent possible during seining and transfer procedures. Complete transfers using a sanctuary net that holds water during transfer to prevent the added stress of an out-of-water transfer.
    iv. Captured fish must be released as near as possible to capture sites.
    v. ESA-listed fish may not be transferred to anyone except NOAA Fisheries personnel.
    vi. Other Federal, state, and local permits necessary to conduct the capture and release activity must be obtained.
    vii. NOAA Fisheries or its designated representative must be allowed to accompany the capture team during the capture and release activity, and must be allowed to inspect the team's capture and release records and facilities.
    viii. A description of any capture and release effort will be included in a post project report, including the name and address of the supervisory fish biologist, methods used to isolate the work area and minimize disturbances to ESA-listed species, stream conditions before and following placement and removal of barriers, the means of fish removal, the number of fish removed by species, the condition of all fish released, and any incidence of observed injury or mortality.
f. If a dead, injured, or sick endangered or threatened species specimen is located, initial notification must be made to the NOAA Fisheries' Law Enforcement Office (telephone 503-325-5934). Care should be taken in handling sick or

injured specimens to ensure effective treatment and care or the handling of dead specimens to preserve biological material in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered and threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not disturbed.

2. To implement reasonable and prudent measure #2 (erosion control), the NRCS shall ensure that:
   a. An erosion and sedimentation control plan (ESCP) is prepared and fully implemented. The ESCP will outline how and to what specifications various erosion control devices will be installed to meet water quality standards, and will provide a specific inspection protocol and time response. Erosion control measures shall be sufficient to ensure compliance with applicable water quality standards and this Opinion. The ESCP shall be maintained on site and shall be available for review upon request. Erosion and sedimentation control measures may include (but are not limited to) the following:
      i. Sediment detention measures such as placement of weed-free straw, silt fences, straw bale barriers, temporary seeding, sediment traps, erosion control blankets or heavy-duty matting (*e.g.*, jute), and construction of temporary settling basins where applicable.
   b. Effective erosion control measures shall be in-place at all times during the contract. Applicable erosion control measures shall be installed prior to any on-the-ground construction activities. Erosion control structures will be maintained throughout the life of the contract, and removed upon completion of construction as appropriate.
   c. Erosion control measures will be applied to all areas of bare soil within seven days of exposure within 150 feet of any natural waterbody. All other areas will be stabilized within 14 days of exposure.
   d. All erosion control devices will be inspected throughout the construction period to ensure that they are working adequately. Should a control measure not function effectively, the control measure will be immediately repaired or replaced. Additional erosion controls will be installed as necessary.

   e. In the event that soil erosion and sediment resulting from construction activities is not effectively controlled, the NRCS will limit the amount of disturbed area to that which can be adequately controlled.
   f. All equipment that is used for instream work will be cleaned prior any in-water work. All mechanized equipment shall work from top-of-bank. External oil and grease will be removed from excavator arms and buckets prior to use below top-of-bank.
   g. Materials removed during excavation shall only be placed in upland locations at least 25 feet from top-of-bank to ensure that excavated materials do not re-enter

the active channel. Conservation of topsoil (removal, storage and reuse) is encouraged.

h. Untreated wash and rinse water will not be discharged into any natural waterbody. Discharge from any pumping will be into a discharge structure to reduce concentrated velocities and minimize scour and erosion.

i. Project actions meet or exceed all provisions of the project's National Pollution Discharge Elimination System permit issued by the ODEQ.

3. To implement reasonable and prudent measure #3 (pollution control), the NRCS shall ensure that:

   a. The contractor develops and implements a site-specific spill prevention, containment, and control plan (SPCCP), and is responsible for containment and removal of any toxicants released.

   b. All spills are reported to NOAA Fisheries.

      i. In the event of a hazardous materials or petrochemical spill, immediate action shall be taken to recover toxic materials and prevent them from further impacting aquatic or riparian resources.

      ii. The in-water work area will have containment measures in place that minimize the potential of petrochemicals or hazardous materials from entering the river.

   c. Refueling and hazardous materials.

      i. The refueling plans include measures to prevent direct discharge of petrochemicals into any natural waterbody.

         (1) Refueling of all equipment takes place at least 150 feet from any waterbody.

         (2) No auxiliary fuel tanks are stored within 150 feet of any waterbody.

         (3) Water pumps will be set in a lined containment structure with 125% capacity to prevent overspill.

   d. No fresh concrete comes in contact with the active flowing channel for a minimum of 72 hours following initiation of curing.

4. To implement reasonable and prudent measure #4 (riparian vegetation protection and enhancement), the NRCS shall ensure that:

   a. Alteration of native vegetation is minimized. Where possible, native vegetation will be removed in a manner that ensures that roots are left intact. Alteration or disturbance of the streambanks shall be minimized.

   b. All exposed areas will have a replanting plan using species native to the project area or region.

   c. The alteration or disturbance of streambanks and existing riparian vegetation is minimized.

   d. No herbicides are applied in association with the proposed action.

   e. The riparian planting sites are monitored for five years with a survival rate or plant cover of 80%.

f. All initial plantings shall occur prior to December 15, 2002.

5. To implement reasonable and prudent measure #5 (monitoring), the NRCS shall ensure that:
   a. Upon completion of construction, a summary of all monitoring data is provided to NOAA Fisheries.
   b. Post-construction monitoring reports describe the success and/or failure, and actions taken to correct failures of all BMPs (to include but not limited to ESCP and SPCCP), confirmation of as-built condition, and documentation of planting success. These reports will be submitted as outlined below.
      i. Post-construction Report. The report on BMPs and as-built component of monitoring will be provided within 60 days following completion of the proposed action, and include a description of:
         (1) Specific methods used to minimize increases in turbidity, to include monitoring data.
         (2) Stream conditions before and following any wet excavation.
         (3) Extent, duration, and frequency of any turbidity plumes related to project activities.
         (4) Any observed injury and/or mortality of fish resulting from project activities.
      ii. Planting Report. Following the completion of plantings associated with the streambank and adjacent riparian zone, annually provide NOAA Fisheries with a report by December 31 describing the success of plantings required under reasonable and prudent Measure #4. The report should focus on actions taken to ensure that plantings were done correctly and success at meeting the objective of 80% or higher survival rate after three years, as well as indicate any replantings completed during the preceding 12-month period. The report shall include photo documentation. Once 80% or greater survival has been documented for three consecutive years, this reporting requirement may be discontinued.

         (1) Monitoring reports shall be submitted to:
         National Marine Fisheries Service
         Oregon Habitat Branch, Habitat Division
         Attn: 2002/00598
         525 NE Oregon Street, Suite 500
         Portland, Oregon 97232-2778

3. MAGNUSON-STEVENS ACT

3.1 Background

On, June 10, 2002, NOAA Fisheries received a letter from the NRCS requesting Essential Fish Habitat (EFH) consultation pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSA) for the subject action. The objective of the EFH consultation is to determine whether the proposed action may adversely affect designated EFH for relevant species, and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH resulting from the proposed action. This consultation is undertaken pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and its implementing regulations (50 CFR 600).

3.2 Magnuson-Stevens Fishery Conservation and Management Act

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires the inclusion of EFH descriptions in Federal fishery management plans. In addition, the MSA requires Federal agencies to consult with NOAA Fisheries on activities that may adversely affect EFH.

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting the definition of essential fish habitat: "Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.110).

Section 305(b) of the MSA (16 U.S.C. 1855(b)) requires that:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH;

- NOAA Fisheries shall provide conservation recommendations for any Federal or state activity that may adversely affect EFH;

- Federal agencies shall within 30 days after receiving conservation recommendations from NOAA Fisheries provide a detailed response in writing to NOAA Fisheries regarding the conservation recommendations. The response shall include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations of NOAA Fisheries, the Federal agency shall explain its reasons for not following the recommendations.

The MSA requires consultation for all actions that may adversely affect EFH, and does not distinguish between actions within EFH and actions outside EFH. Any reasonable attempt to

encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities, that may have an adverse effect on EFH. Therefore, EFH consultation with NOAA Fisheries is required by Federal agencies undertaking, permitting or funding activities that may adversely affect EFH, regardless of its location.

3.3 Identification of EFH

The Pacific Fisheries Management Council (PFMC) has designated EFH for three species of Pacific salmon: chinook (*O. tshawytscha*), coho (*O. kisutch*), and Puget Sound pink salmon (*O. gorbuscha*) (PFMC 1999). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC), and longstanding, naturally-impassable barriers (*i.e.*, natural waterfalls in existence for several hundred years). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of potential adverse effects to these species' EFH from the proposed action is based on this information.

3.4 Proposed Action

The proposed action is detailed above in section 1.2 of this document. For this consultation, the action area includes the Drift Creek watershed. This area has been designated as EFH for various life stages of chinook salmon, coho salmon, and groundfish species (Table 3).

Table 3. Species with designated EFH found in waters of the State of Oregon.

Ground Fish Species	Blue rockfish (*S. mystinus*)	Rougheye rockfish (*S. aleutianus*)	Flathead sole (*Hippoglossoides elassodon*)
Leopard shark (*Triakis semifasciata*)	Bocaccio (*S. paucispinis*)	Sharpchin rockfish (*S. zacentrus*)	Pacific sanddab (*Citharichthys sordidus*)
Soupfin shark (*Galeorhinus zyopterus*)	Brown rockfish (*S. auriculatus*)	Shortbelly rockfish (*S. jordani*)	Petrale sole (*Eopsetta jordani*)
Spiny dogfish (*Squalus acanthias*)	Canary rockfish (*S. pinniger*)	Shortraker rockfish (*S. borealis*)	Rex sole (*Glyptocephalus zachirus*)
Big skate (*Raja binoculata*)	Chilipepper (*S. goodei*)	Silvergray rockfish (*S. brevispinus*)	Rock sole (*Lepidopsetta bilineata*)
California skate (*R. inornata*)	China rockfish (*S. nebulosus*)	Speckled rockfish (*S. ovalis*)	Sand sole (*Psettichthys melanostictus*)
Longnose skate (*R. rhina*)	Copper rockfish (*S. caurinus*)	Splitnose rockfish (*S. diploproa*)	Starry flounder (*Platyichthys stellatus*)
Ratfish (*Hydrolagus colliei*)	Darkblotched rockfish (*S. crameri*)	Stripetail rockfish (*S. saxicola*)	
Pacific rattail (*Coryphaenoides acrolepsis*)	Grass rockfish (*S. rastrelliger*)	Tiger rockfish (*S. nigrocinctus*)	**Coastal Pelagic Species**
Lingcod (*Ophiodon elongatus*)	Greenspotted rockfish (*S. chlorostictus*)	Vermillion rockfish (*S. miniatus*)	Northern anchovy (*Engraulis mordax*)
Cabezon (*Scorpaenichthys marmoratus*)	Greenstriped rockfish (*S. elongatus*)	Widow Rockfish (*S. entomelas*)	Pacific sardine (*Sardinops sagax*)
Kelp greenling (*Hexagrammos decagrammus*)	Longspine thornyhead (*Sebastolobus altivelis*)	Yelloweye rockfish (*S. ruberrimus*)	Pacific mackerel (*Scomber japonicus*)
Pacific cod (*Gadus macrocephalus*)	Shortspine thornyhead (*Sebastolobus alascanus*)	Yellowmouth rockfish (*S. reedi*)	Jack mackerel (*Trachurus symmetricus*)
Pacific whiting (Hake) (*Merluccius productus*)	Pacific Ocean perch (*S. alutus*)	Yellowtail rockfish (*S. flavidus*)	Market squid (*Loligo opalescens*)
Sablefish (*Anoplopoma fimbria*)	Quillback rockfish (*S. maliger*)	Arrowtooth flounder (*Atheresthes stomias*)	
Aurora rockfish (*Sebastes aurora*)	Redbanded rockfish (*S. babcocki*)	Butter sole (*Isopsetta isolepsis*)	**Salmon**
Bank Rockfish (*S. rufus*)	Redstripe rockfish (*S. proriger*)	Curlfin sole (*Pleuronichthys decurrens*)	Coho salmon (*O. kisutch*)
Black rockfish (*S. melanops*)	Rosethorn rockfish (*S . helvomaculatus*)	Dover sole (*Microstomus pacificus*)	Chinook salmon (*O. tshawytscha*)
Blackgill rockfish (*S. melanostomus*)	Rosy rockfish (*S. rosaceus*)	English sole (*Parophrys vetulus*)	

3.5 Effects of Proposed Action

The proposed action is likely to cause elevated concentrations in total suspended solids and a temporary loss of benthic habitat for macroinvertebrates, rearing habitat for chinook and coho salmon, and possible chemical contamination.

3.6 Conclusion

NOAA Fisheries believes that the proposed action may adversely affect the EFH for Pacific salmon, ground fishes, and pelagic fishes.

3.7 EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the Magnuson-Stevens Act, NOAA Fisheries is required to provide EFH conservation recommendations for any Federal or state agency action that would adversely affect EFH. The Conservation Recommendations outlined above in section 1.7 and all of the reasonable and prudent measures and the terms and conditions contained in sections 2.2 and 2.3 are applicable to Pacific salmon, ground fishes, and pelagic fishes EFH. Therefore, NOAA Fisheries incorporates each of those measures here as EFH conservation recommendations.

3.8 Statutory Response Requirement

Please note that the Magnuson-Stevens Act (section 305(b)) and 50 CFR 600.920(j) requires the Federal agency to provide a written response to NOAA Fisheries after receiving EFH conservation recommendations within 30 days of its receipt of this letter. This response must include a description of measures proposed by the agency to avoid, minimize, mitigate or offset the adverse impacts of the activity on EFH. If the response is inconsistent with a conservation recommendation from NOAA Fisheries, the agency must explain its reasons for not following the recommendation.

3.9 Supplemental Consultation

The NRCS must reinitiate EFH consultation with NOAA Fisheries if either action is substantially revised or new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920).

4. LITERATURE CITED

Berg, L. 1983. Effects of short term exposure to suspended sediments on the behavior of juvenile coho salmon. Master's Thesis. University of British Columbia, Vancouver, B.C. Canada.

Berg, L. and T.G. Northcote. 1985. Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon (*Oncorhynchus kisutch*) following short-term pulses of suspended sediment. Canadian Journal of Fisheries and Aquatic Sciences 42:1410-1417.

Bjornn, T.C., and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. Pages 83-138 *in* W.R. Meehan, ed. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19:83-138.

Botkin, D., K. Cummins, T. Dunne, H. Regier, M. Sobel, and L. Talbot. 1995. Status and future of salmon of western Oregon and northern California: findings and options. Report #8. The Center for the Study of the Environment, Santa Barbara, California.

FEMAT (Forest Ecosystem Management Assessment Team). 1993. Forest ecosystem management: an ecological, economic, and social assessment. Report of the Forest Ecosystem Management Assessment Team. U.S. Government Printing Office 1993-793-071. U.S. Government Printing Office for the U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Land Management, and National Park Service; U.S. Department of Commerce, National Oceanic and Atmospheric Administration and National Marine Fisheries Service; and the U.S. Environmental Protection Agency.

Gammon, J.R. 1970. The effects of inorganic sediment on stream biota. Environmental Protection Agency, Water Quality Office, water pollution control research series 18050DWC12/70.

Gregory, R.S., and C.D. Levings. 1998. Turbidity reduces predation on migrating juvenile Pacific salmon. Transactions of the American Fisheries Society 127:275-285.

Jacobs, S., J. Firman, and G. Susac. 2001. Status of Oregon coastal stocks of anadromous salmonids, 1999-2000: Monitoring program report number OPSW-ODFW-2001-3, Oregon Department of Fish and Wildlife, Portland, Oregon.

Lichatowich, J. A. 1989. Habitat alteration and changes in abundance of coho *(Oncorhynchus kisutch)* and chinook *(Oncorhynchus tshawyscha)* salmon in Oregon's coastal streams. *In* C. D. Levings, L. B. Holtby, and M. A. Henderson (editors), proceedings of the national workshop on effects of habitat alteration on salmonidsStocks, May 6-8, 1987, Nanaimo, B.C., p. 92-99. Can. Spec. Publ. Fish. Aquat. Sci. 1 05. *In* C.D. Levings, L. B. Holyby.

Lloyd, D.S. 1987. Turbidity as a water quality standard for salmonid habitats in Alaska. North American Journal of Fisheries Management 7:34-45.

Lloyd, D.S., J.P. Koenings, and J.D. LaPerriere. 1987. Effects of turbidity in fresh waters of Alaska. North American Journal of Fisheries Management 7:18-33.

Neff, J.M. 1985. Polycyclic aromatic hydrocarbons. Pages 416-454 in G.M. Rand and S.R. Petrocelli. Fundamentals of aquatic toxicology, Hemisphere Publishing, Washington, D.C.

Newcombe, C. P., and D. D. MacDonald. 1991. Effects of suspended sediments on aquatic ecosystems. North American Journal of Fisheries Management 11:72-82.

Nickelson, T.E., J.W. Nicholas, A.M. McGie, R.B. Lindsay, D.L. Bottom, R.J. Kaiser, and S.E. Jacobs. 1992. Status of anadromous salmonids in Oregon coastal basins. Oregon Department of Fish and Wildlife, Research Development Section and Ocean Salmon Management, 83 pp. Oregon Department of Fish and Wildlife, P.O. Box 59, Portland.

NMFS (National Marine Fisheries Service). 1996. Making endangered species act determinations of effect for individual and grouped actions at the watershed scale. Habitat Conservation Program, Portland, Oregon. September 4, 1996.

Noggle, C.C. 1978. Behavioral, physiological and lethal effects of suspended sediment on juvenile salmonids. [Thesis] Seattle: University of Washington.

OCSRI (Oregon Coastal Salmon Restoration Initiative). 1997. State of Oregon, Salem. March 10.

ODAS (Oregon Department of Administrative Services). 1999. Oregon economic and revenue forecast. Vol. XIX. No. 2. Office of Economic analysis, Salem.

ODEQ (Oregon Department of Environmental Quality). 2001. Oregon's Final 1998 Water Quality Limited Streams - 303(d) List, Record ID 2737.

ODFW (Oregon Department of Fish and Wildlife). 2000. Memorandum from Patty Snow: Updated in-water timing guidelines. June 12, 2000.

ODFW (Oregon Department of Fish and Wildlife). 2000. Guidelines for timing of in-water work to protect fish and wildlife resources. 12 p. (http://www.dfw.state.or.us/ODFWhtml/InfoCntrHbt/0600_inwtrguide.pdf).

PFMC (Pacific Fishery Management Council). 1999. Amendment 14 to the Pacific coast salmon plan. Appendix A: Description and identification of essential fish habitat, adverse impacts and recommended conservation measures for salmon. Portland, Oregon.

Redding, J. M., C. B. Schreck, and F. H. Everest. 1987. Physiological effects on coho salmon and steelhead of exposure to suspended solids. Transactions of the American Fisheries Society 116:737-744.

Rodgers, J.D. 2001. Monitoring of the abundance of juvenile salmonids in Oregon coastal streams. Monitoring program report number OPSW-ODFW-2001-1, Oregon Department of Fish and Wildlife, Portland, Oregon.

Servizi, J. A., and Martens, D. W. 1991. Effects of temperature, season, and fish size on acute lethality of suspended sediments to coho salmon. Canadian Journal of Fisheries and Aquatic Sciences 49:1389-1395.

Sigler, J. W., T. C. Bjornn, and F. H. Everest. 1984. Effects of chronic turbidity on density and growth of steelheads and coho salmon. Transactions of the American Fisheries Society 113:142-150.

Spence, B.C., G.A. Lomnicky, R.M. Hughes, and R.P. Novitzki. 1996. An ecosystem approach to salmonid conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, Oregon. 356 p.

U.S. Forest Service. 1996. Drift (Siletz) watershed analysis. Siuslaw National Forest, Hebo Ranger District.

Weitkamp, L.A., T.C. Wainwright, G.J. Bryant, G.B. Milner, D.J. Teel, R.G. Kope, and R.S. Waples. 1995. Status review of coho salmon from Washington, Oregon, and California. U.S. Departrtment of Commerce, NOAA Technical Memo. NMFS-NWFSC-24, 258 p.